

Differentiating Mathematics Instruction for Multilingual Students using Critical Sociocultural Practices

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Abstract

This paper defines and elaborates on a three-tiered transformative approach to differentiating mathematics instruction for multilingual learners, which includes increasing use of small group instruction, improving the quality of assistance during learning, and creating a culture of recognition that affirms all learners. Using supporting evidence from instructional coaching studies, this paper identifies challenges faced by general education mathematics teachers at each tier of differentiation. While coached elementary and secondary teachers made significant gains in implementing this approach to differentiation, secondary mathematics teachers, in particular, had significantly less growth. Implications for increasing mathematics teachers' knowledge and skills in differentiating instruction for multilingual learners are addressed.

Discussion And Reflection Enhancement (DARE) Pre-Reading Questions

1. What does differentiated instruction mean to you and what does it look like in your school or classroom?
2. What do you believe are essential components of effective pedagogy for multilingual learners?

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Introduction

Stepping back and looking at how far my individual kiddos have really come was a big takeaway for me today [...] I mean looking at the difference. You get so used to hearing them come out now—and all shouting and having a voice and being excited about math—that you go, ‘We weren't always here.’ But the takeaway is definitely looking how far each of them have come, and how far I have come. My questioning is so different. The way I think about teaching is so different. I'm going to be 100% honest when I say that I feel like I am a lot smarter too, because they teach me stuff that I would have never thought of. (Mrs. Mullen, 3rd grade teacher)

Differentiating instruction (i.e., providing multiple ways of learning to students with varying abilities and/or needs) is a daily challenge for teachers tasked with meeting a wide range of learners’ needs in the general education classroom. Differentiating instruction for multilingual students, who are linguistically and culturally distinct from peers whose culture or language is historically dominant, adds another layer to this challenge. Multilingual students may benefit from 30-minute pull-out or push-in English as a Second Language (ESL) support, yet they still spend the vast majority of their day with general education teachers. More often than not, general education teachers have not been prepared with sustained professional development or coursework for making content accessible to, or promoting English development among, multilingual students (Hollins & Guzman, 2005; Lucas & Grinberg, 2008; Wei, Darling-Hammond, & Adamson, 2010). As Horn (2012) observed, minority students have historically been underserved in mathematics classrooms. Mathematics teachers are not exempt from this critique.

Teachers’ pedagogical practices are a major factor influencing multilingual student engagement and success

in mathematics (Horn, 2012; Crisp & Nora, 2012). Unfortunately, all too often standard teacher pedagogy in K-12 schools remains whole-class, lecture-dominated, worksheet-driven, and behaviorist in orientation with little evidence of meaningful differentiation (e.g., Teemant, 2014; Teemant, Cen, & Wilson, 2015). Baglieri, Bejoian, Broderick, Connor, and Valle (2011) observed that such practices “teach to the middle” and are built upon assumptions of:

an unexamined normative center, a center built on the desirability (and therefore expectation) of all students being taught at the same time, in the same way, learning at the same rate, and demonstrating their knowledge and skills in the same way, presumably on the same examinations. (pp. 2137-38).

This paper aims to describe the necessary conditions for creating a learning environment for multilingual learners in general education mathematics classroom that is both more equitable and more effective. Built upon critical (Freire, 1994) and sociocultural perspectives (Vygotsky, 1978, 1997), we describe a three-tiered approach to meaningful and transformative differentiation based on changing classroom organization, designing activities to promote learning, and cultivating a culture of recognition. We draw on a synthesis of quantitative and qualitative research outcomes from several instructional coaching studies to capture elementary and secondary mathematics teachers’ pedagogical challenges and successes implementing critical sociocultural practices (i.e., Teemant, 2014, 2018; Teemant, Cen, & Wilson, 2015; Teemant, Leland, & Berghoff, 2014; Teemant & Hausman, 2018). After defining critical sociocultural pedagogy, we describe each tier of transformative differentiation from the perspective of mathematics teachers, identifying challenges, successes, and implications for practice.

What are critical sociocultural practices?

Broadly, sociocultural theory posits learning to be a socially mediated (as opposed to individually contained) and culturally situated (as opposed to culturally neutral)

phenomenon (Vygotsky, 1930-1934/1978). Critical perspectives on pedagogy focus on power dynamics both in classrooms and in larger society. Increasingly, sociocultural perspectives (Lucas & Villegas, 2011; Moll, 2001) and critical social theory (Gottesman, 2016;

STANDARDS FOR Effective Pedagogy

STANDARD 1 **Joint Productive Activity (JPA) Teacher and Students Producing Together**
Facilitate learning through joint productive activity among teacher and students.
Enacting Level: The teacher and a small group of students collaborate on a shared product.

STANDARD 2 **Language & Literacy Development (LLD)
Developing Language and Literacy Across the Curriculum**
Develop competence in the language and literacy of instruction across the curriculum.
Enacting Level: The teacher provides structured opportunities for students to engage in sustained reading, writing, or speaking activities; and assists academic language use or literacy development by questioning, rephrasing, or modeling.

STANDARD 3 **Contextualization (CTX)
Making Meaning: Connecting School to Students' Lives**
Connect teaching and curriculum to experiences and skills of students' home and community.
Enacting Level: The teacher integrates the new activity/information with what students already know from home, school, or community.

STANDARD 4 **Challenging Activities (CA) Teaching Complex Thinking**
Challenge students toward cognitive complexity.
Enacting Level: The teacher designs and enacts challenging activities with clear standards and performance feedback, and assists the development of more complex thinking.

STANDARD 5 **Instructional Conversation (IC) Teaching Through Conversation**
Engage students through dialogue, especially the Instructional Conversation.
Enacting Level: The teacher has a planned, goal-directed conversation with a small group of students on an academic topic; elicits student talk by questioning, listening, and responding to assess and assist student understanding; and inquires about students' views, judgments, or rationales. Student talk occurs at higher rates than teacher talk.

STANDARD 6 **Critical Stance (CS) Teaching to Transform Inequities**
Empower students to transform society's inequities through democracy and civic engagement.
Enacting Level: The teacher consciously engages learners in interrogating conventional wisdom and practices, reflecting upon ramifications, and seeking actively to transform inequities within their scope of influence in the classroom and larger community.

Be On Target! **PROJECT TARGETT**

Center for Research on Education, Diversity & Excellence (CREDE) | <http://crede.berkeley.edu>
Center for Urban and Multicultural Education (CUME) | IUPUI | <http://education.iupui.edu/cume/> TRANSFORMING AND RENEWING GROWTH OF EDUCATORS AND TEACHERS OF TEACHERS

Figure 1. The Six Standards for Effective Pedagogy

Salazar, 2013) are being used as theoretical foundations for understanding and teaching multilingual and multicultural students. Critical sociocultural theory embraces both of these theoretical worlds. This theory forms the basis for the Six Standards for Effective Pedagogy (Six Standards, Figure 1) a system of pedagogical principles of learning that adhere to critical sociocultural perspectives (Tharp, Estrada, Dalton, & Yamauchi, 2000; Teemant et al., 2014).

From sociocultural theory, the Six Standards focus on the quality of teacher-student relationships, envisioned as an active, socially and culturally shaped spaces, filled with rich dialogue and assistance. More knowledgeable others, such as teachers, provide timely assistance in the process of learning in what is called a student's zone of proximal development. Teacher assistance is enacted pedagogically when learning is collaborative, language rich, contextualized in students' lived experiences, cognitively challenging, and dialogic in the co-construction of knowledge (standards 1-5 in Figure 1). Assistance in the learning process is intended to promote future self-regulation and automaticity in learning concepts and language.

From a critical perspective, the sixth standard—critical stance—invites and empowers students to transform the inequities in their worlds through dialogic cycles of reflection and engagement. Pedagogically, this happens as students learn to (a) question the status quo, (b) interrogate it from multiple sociopolitical viewpoints, and (c) take action to promote greater equity (Lewison, Flint, & Van Sluys, 2002; Teemant et al., 2014). For Michael Apple (cited in Gottesman, 2016), two principles guide critical education: relational thinking (i.e. understanding activities, such as schooling, as being situated within larger social institutions and movements) and political and cultural repositioning (i.e. understanding education through multiple perspectives, particularly those of the historically disadvantaged). Such learning uses school, home, and community knowledge in tandem to examine “asymmetries of power and privilege” (McLaren, 2007, p. 69) that shape students' identities, relationships, and agency in and outside the classroom.

Taken together, the Six Standards represent critical sociocultural principles of learning that guide teachers' instructional design. Teachers are supported in employing the Six Standards through a combination of a 30-hour summer workshop and seven cycles of individual instructional coaching across a school-year, with the ultimate goal of designing and implementing multiple, simultaneous, and differentiated small group activities that evidence at least three of the Six Standards employed concurrently. For example, an activity could create an extended opportunity for students to meaningfully collaborate and authentically use language to accomplish a shared task while also being cognitively challenging and/or contextualized (Standards 1, 2, 3, and/or 4). Six Standards classrooms have (a) multiple student-led small group activities with heterogeneously grouped students; and (b) a teacher-led activity with homogeneously grouped students. When a teacher is a full partner in the co-construction of knowledge in a small group, students receive the highest level of assistance to learn. (See chapters 6 and 7 in Tharp et al. [2000] for a rich description of the instructional model that accompanies use of the Six Standards pedagogy.)

Critical sociocultural perspectives, particularly as enacted through the Six Standards, expand conceptions and enactments of differentiation. In addition to focusing on alternative content, products, processes, or environments for learning, teachers also intentionally take into account the sociocultural, historical, political, economic, and relational conditions that have shaped students' identities, power, and agency in and outside the classroom. Learning for the sake of learning is replaced with learning to collaboratively and reflectively change self and society (Ettling, 2012; Freire, 1994). Differentiation, therefore, should result in teaching that is responsive and pluralistic, and students who are increasingly autonomous in their thinking, relationships, and choices.

The Three-Tiered Pedagogical Approach to Differentiation

Based on longitudinal studies of Six Standards instructional coaching with elementary and secondary teachers, including mathematics teachers (Teemant et al., 2014; Teemant & Hausman, 2018), we have defined three

pivotal changes teachers make to realize an enriched pedagogical approach to differentiation. Figure 2 presents the three tiers of this approach as an inverted pyramid. Tier One (the top of Figure 1) is the quickest, broadest, and easiest change teachers make in their practice. Tiers Two and Three represent more nuanced and difficult changes, requiring sustained and intentional effort on the part of teachers.

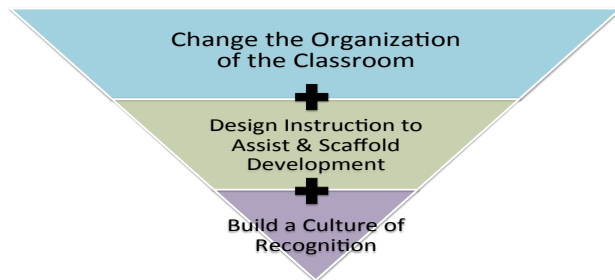


Figure 2. A three-tiered approach to transformative differentiation

1. Change Classroom Organization

It is an overarching theme in my class essentially when I tell my kids, we are going to start today with Math Centers. Woo-hoo!! I had taken a picture of that actually and my dad came to visit from Virginia, and he was looking through my pictures, and he said... “Now those are faces of children who love being and doing what they are doing.” He said, “That is a genuine smile.” I said, “That is because they wanted to answer a question that I asked. It was a very difficult question and they had worked for it and they were excited to answer.” (Mrs. Dinah, 3rd grade teacher)

To improve differentiation, the first shift teachers of mathematics have to make is more frequent use of small group learning activities. Increasing the amount and quality of small group work simultaneously increases the amount of student talk, negotiation and co-construction of meaning, and opportunities for peer or teacher assistance in the learning process. Verbal interactions make academic concepts and language more accessible to students. Teemant and Hausman (2013) found that use of collaborative small group activities, in particular, significantly increased student achievement among both native and non-native speakers of English. Such

arrangements also provide more opportunities for students to draw on and display their own funds of knowledge. A third-grade teacher in her tenth year of teaching described herself as an “old school” teacher, who lectured and asked students to complete textbook worksheets. After coaching, she had learned to trust her classroom management and her students:

I am more apt to letting the kids talk to each other and learn from each other, and just amazed at how much they can learn from each other without me being right there beside them the whole time, basically giving them the information. And they are able to help each other in ways that I didn't think was possible.

For all of the established benefits of small group work, our coaching studies revealed classroom management skills as the main challenge at this tier of differentiation for elementary and secondary teachers. Teemant (2014) and Teemant et al. (2015) found that by the end of seven cycles of coaching, 100% of elementary teachers and 89% of secondary humanities teachers were able to consistently manage small group activities, but only 25% of secondary mathematics and science teachers were able to do so. In focus group discussions, secondary mathematics teachers, in particular, shared that they lacked confidence in managing students working in multiple groups. One secondary teacher struggled with “Dealing with those [students] that are loud and boisterous and want to be disruptive on the other side of the room when you're trying to deal with a group over here.” He continued “that causes the centers to sometimes break down.” Another secondary teacher explained, “I've been much more inclined to stop, and if I notice conversations among students, find out—don't assume—that they're off task... to discern what's going on, and if there *is* learning going on.”

As the routines, procedures, behaviors, and expectations are consistently presented and reinforced, small group work can be productive. Without more frequent use of small group configurations, students remain passive in their learning and lose out on important opportunities for assistance in the process of learning, application of developing language skills, and connection of material to their own lived experience. This suggests mathematics teachers, especially secondary teachers, benefit from

concrete support, techniques, and procedures for shifting away from whole-class lecture to use of small group activities as a first step in improving differentiation.

2. Design Activities to Assist and Promote

Development

I think it is because I have always encouraged them to explain why. Explain your thinking. Give evidence. So even when we are talking, like when we are reviewing, saying, okay, great, you have finished with this puzzle, but now let's talk about it. And I think they are getting so used to taking the pieces apart again and talking about why they are where they are. Even when we were reviewing, all standing up together talking, they would say, "Oh, I like how the right angle is next to 90 degrees. Why? I love that you like that, but why?" Then they have to explain that farther, and then once they have that connection, then I will expand on the data, get someone else thinking and then they will chime in and it turns into.... I think they are getting used to that. (Mrs. Mullen, 3rd grade teacher)

As a second tier of differentiation, we found teachers benefitted in coaching from time to time to reflect and think of ways to improve on how they actually assisted students while learning. Our data showed that teachers, having implemented small group activities, spent a majority of their time floating around the classroom to monitor or audit learning rather than assisting students to learn. Figure 3 describes teacher practices at the highest level of fidelity in use of the Six Standards pedagogy based on the observation rubric (Doherty, Hilberg, Epaloose, & Tharp, 2002; Teemant et al., 2014). The Six Standards required teachers to hone their skills in asking questions, eliciting student talk, and pressing students for evidence to support their thinking. It asked them to become full participants with students in the co-construction of learning in small groups. Teachers focused on communicating

expectations, setting clear standards for quality work, and assisting and giving formative feedback. They started with students' informal understandings of concepts from home, school, or community, and consciously applied school learning to real-world settings, concerns, and inequities within the students' collective spheres of influence.

Teachers felt the standards of joint productive activity and the instructional conversation allowed them to create more student-centered classrooms. One teacher noted that her students "actually liked it better because they're getting more, not one-on-one tutoring, but more teaching in a very small group versus the entire class." An elementary teacher described her experience learning to assist student learning this way:

If we want to add this amount of money in because we want to purchase this, this is one way we can do it, and another student said, "Oh, that's a cool way. Let me show you how I did it." And, they were able to find different ways, and then later on when we were doing an assessment, I saw them doing that way that they hadn't done before. So it was a different way that was more comfortable for them. So that really helped out. But also, I was amazed by the conversations that they would have, even with me just sitting there. I would maybe guide them in a question, and they would talk to each other and have more of, I would say, an adult conversation that I didn't think kids could have. I thought it was all, you know, toys and movies and more current event things. I didn't think they could have a conversation about math as much. And so, they were able to have that conversation and build off each other and make observations around their world that I didn't think they even noticed. (Mrs. Dinah, 3rd grade teacher)

Individual Standards	Enacting Level of Fidelity for Individual Standards
Joint Productive Activity <i>Teacher and Students Producing Together</i>	The teacher and a small group of students collaborate on a joint product. (Teacher does not float.)
Language & Literacy Development <i>Developing Language and Literacy Across the Curriculum</i>	The teacher designs and enacts instructional activities that <i>generate</i> language expression and development of ‘content vocabulary,’* AND <i>assists student language use or literacy development</i> through questioning, rephrasing, or modeling. (Teacher can float.)
Contextualization <i>Making Meaning – Connecting School to Students’ Lives</i>	The teacher integrates the new activity/academic concepts with students’ prior knowledge from home, school, or community to connect everyday and schooled concepts. (Teacher does not have to be present. This can be about activity design.)
Challenging Activities <i>Teaching Complex Thinking</i>	The teacher designs and enacts challenging activities with clear standards/expectations and performance feedback, AND assists* the development of more complex thinking. (Teacher can float.)
Instructional Conversation <i>Teaching Through Conversation</i>	The teacher designs and enacts an instructional conversation (IC) with a clear ‘academic goal’; listens carefully to assess and assist student understanding; AND questions students on their views, judgments, or rationales. Student talk occurs at higher rates than teacher talk. (No floating.)
Critical Stance <i>Teaching to Transform Inequities</i>	The teacher designs or facilitates instruction that consciously engages learners in a) interrogating conventional wisdom and practices; AND b) reflection upon ramifications of such practices; AND c) actively seeks to transform inequities within their scope of influence within the classroom and larger community.

Figure 3. Highest Level of Fidelity for Enacting Critical Sociocultural Practices by Individual Standard

At a time when the Common Core State Standards Initiative (NGA & CCSSO, 2010) describes mathematics practices that encourage students to discuss, solve problems, and communicate findings (Johnson, 2010), the Six Standards provides a rich model for assisted learning. Six Standards coaching supported both elementary and secondary mathematics teachers to significantly increase the quality of collaboration, language use, contextualization, higher order thinking, and evidence-based dialogue to deepen learning.

Implementing these principles can be challenging, however, as in many ways they stand in stark contrast to the roles and approaches that teachers are familiar with. As one teacher noted,

I started with how I was taught. I modeled after, you know, how I was raised, like with math. Even last year, the kids would get a mini lesson which I did. They would work in their books. They would take home a worksheet for homework. They would turn it in, and the next

day we would go to the next unit. That was just that. That was the way that I grew up doing math. (Mrs. Mullen, 3rd grade teacher)

It can be difficult for teachers to adopt new pedagogies when they bear little resemblance to those they experienced as students (Lortie, 1977). Further, Teemant et al. (2015) found evidence that this challenge can vary across content areas, with secondary mathematics and science teachers implementing each of the Six Standards to a lesser extent than their humanities-focused secondary or elementary colleagues. In general, they consistently provided less assistance and feedback to students, with a common explanation being that teaching as telling (traditional, lecture-based pedagogy) is more efficient than teaching as meaningful dialogic interaction (critical sociocultural pedagogy).

When activities were designed to promote learning, the benefits were evident. Six Standards instructional coaching studies with elementary teachers of mathematics

have shown a consistent pattern of statistically significant gains in measures of student achievement and English proficiency (Teemant & Hausman, 2018). For example, students of coached teachers scored 10 points higher on the LAS Links overall score of English proficiency (2012-13 data) and 19 points higher on WIDA ACCESS overall score of English proficiency (2014-15) than students of uncoached teachers. On tests of mathematics achievement, students of coached teachers scored 15 points higher than peers taught by uncoached teachers (2012-2013 data) and 11 points higher on both the K-1 and 2nd grade spring NWEA math tests. When teachers actively and intentionally assisted students during the learning process by enacting critical sociocultural forms of assistance, there were statistically significant gains in student achievement and English proficiency for multilingual learners, which is similar to studies of elementary literacy findings (e.g., Doherty & Hilberg, 2007; Doherty, Hilberg, Pinal, & Tharp, 2003; Estrada, 2005; Saunders & Goldenberg, 1999; Teemant & Hausman, 2013).

3. Create a Classroom Culture of Recognition

So, now they are making those real-world connections and it is really cool. Even, Carla—outside—she was like “Ms. Mullen, I just want to let you know that four out of the ten slides or four out of the ten swings are being used right now.” I’m like “What do you mean?” She is like, “Four/tenths of the swings are being used right now.” I’m like, “Are you doing fractions? [laughter] At recess?” (Mrs. Mullen, 3rd grade teacher)

The most challenging, and often most ignored, aspect of differentiation is building a culture of recognition within the classroom that honors and affirms students’ identities as learners and people. As Rodriguez (2012) describes, this includes ongoing efforts to build meaningful relationships with students, which is not included in the standard pacing guides. It also means tailoring instruction to reflect students’ real-world experiences, their local community, their own voice and choices in learning, as well as forms of civic engagement to improve conditions in their sphere of influence. The Six Standards, especially the standard of critical stance, represent one way of accomplishing Rodriguez’s pedagogical and transformative aspects of teaching.

Building such a culture can be challenging, as this approach goes against the commonly held understanding of classrooms and content areas as culturally and politically neutral. A teacher might be wary of courting controversy by treating classrooms otherwise. However, a critical sociocultural perspective holds that this idea of neutrality is just another form of “teaching to the middle.” Differentiating instruction for multicultural learners means understanding that notions of neutrality are an illusion and that classrooms need to be open to students’ cultural perspectives and experiences, which may be different than dominant culture or the textbook. The secondary teachers highlighted the benefits of community building in the Six Standards model. A secondary teacher shared: “The more the kids got to know each other, the more they could co-participate and feel accountable to each other [...] That was a surprise, how well, how effective that was, building the community as a foundation to having a center.” A elementary teacher was pleased to see students “helping each other” to learn. Another elementary teacher explained how important it was to include her students’ home experiences in learning. She observed that asking them, “How many clocks do you have at home? What time do you cook dinner?” And have them looking for that stuff in their real world helps out a lot.” She continued that letting them “create from their own experiences has been really huge.”

Studies by Teemant et al. (2014), Teemant et al. (2015), and Teemant (2018) demonstrate that all elementary and secondary teachers, including teachers of mathematics, need more time and support to fully realize a culture of recognition in their classrooms. High stakes accountability has pressured teachers to pay more attention to testing at the cost of thoughtfully building on what students already know from home, school, and community. Teachers, unfortunately, feel they need permission to build relationships, tailor curriculum, or apply school concepts to the real world. Yet, there is evidence that even modest gains in teachers’ use of critical stance significantly increases both students’ content and English learning (Teemant & Hausman, 2018).

Conclusion

Improving mathematics teachers' abilities to differentiate instruction for the benefit of their multilingual students requires becoming more dialogic, responsive, and inclusive in practice. The Six Standards coaching studies have shown that teachers significantly increase multilingual students' achievement and English proficiency by increasing use of small group configurations, assisting students in the process of learning, and creating an affirming classroom culture that takes into account who learners are influenced by home, school, and community. While each tier of differentiation presents its own set of challenges, the findings from Six Standards instructional coaching also suggest teachers who receive timely, meaningful, and ongoing assistance are able to improve their skills in classroom management, providing assistance and feedback, and tailoring curriculum to students' life inside and outside the classroom. Teachers who are consciously competent in the Six Standards quantitatively and qualitatively improve students' learning experiences with mathematics. (For additional articles see this project site: <https://www.researchgate.net/project/Critical-Sociocultural-Instructional-Coaching-Six-Standards-Mixed-Methods>).

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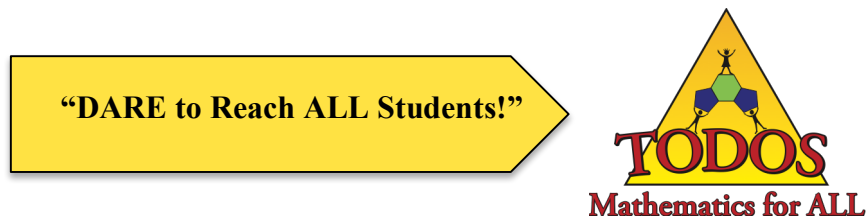
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Discussion And Reflection Enhancement (DARE) Post-Reading Questions

1. How different is it to view learning with a social and cultural context instead of just within individual learners?
2. What does it mean for teaching to be culturally neutral? Would you describe your own teaching this way? Explain.
3. Which of the Six Standards for Effective Pedagogy (Figure 1) resonates most for you? Which do you find hard to understand or implement? Why do you think that is?
4. What is one concrete change you could readily try soon in your teaching that would lead to more differentiation?



Call for Manuscripts for *TEEM*

We encourage the submission of manuscripts, including applied or action research, literature surveys, thematic bibliographies, commentary on critical issues in the field, professional development strategies, and classroom activities and resources. While contributions in English are recommended, *TEEM* will also consider contributions in languages such as Spanish. The *TEEM* Editors welcome query emails about the suitability of proposed topics: email at teem@todos-math.org.

TEEM is very interested in receiving manuscripts from classroom teachers and/or teacher educators. The following are suggested ideas for manuscripts in this category:

- A description, discussion or reflection on implementation of a particular teaching strategy
- A specific classroom-tested TODOS-oriented “excellence and equity” activity accompanied by a blackline worksheet for classroom use
- A focus on some aspect of the TODOS mission and related goals:
 - to advocate for an equitable and high quality mathematics education for all students;
 - to implement lessons and programs that incorporate the role that language and culture play in learning mathematics;
 - to inform the public, including parents, and influence educational policies in ways that enable students to become mathematically proficient: and
 - to inform teacher education programs.

For more details on the guidelines for papers, see <http://www.todos-math.org/teem>.